How to Write an Abstract That Will Be Accepted for Presentation at a National Meeting

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Preparation, submission, and presentation of an abstract are important facets of the research process, which benefit the investigator/author in several ways. Writing an abstract consists primarily of answering the questions, "Why did you start?" "What did you do?" "What did you find?" and "What does it mean?" A few practical steps in preparing to write the abstract can facilitate the process. This article discusses those steps and offers suggestions for writing each of an abstract's components (title, author list, introduction, methods, results, and conclusions); considers the advantages and disadvantages of incorporating a table or figure into the abstract; offers several general writing tips; and provides annotated examples of well-prepared abstracts: one from an original study, one from a method/device evaluation, and one from a case report. *Key words: research, abstracts, writing, publications, research methodology, devices, equipment evaluation, case report, medical illustration, communication, conferences and congresses*. [Respir Care 2004;49(10):1206–1212.

Introduction

Preparation, submission, and presentation of an abstract are important stages in the life cycle of a research project. Though not all studies go through these stages, most do. There are a number of advantages to the abstract writing and presenting process, as opposed to simply preparing a manuscript and submitting it for publication once the study has been completed. By requiring the investigator/author to reduce the whole project into a brief synopsis, it forces concentration on the most important aspects of the study's purpose, design, findings, and implications, and in so do-

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ing clarifies the writer's thinking about the project. It moves the project along the path to preparation of the full manuscript (something that intimidates many novice authors) by necessitating a concise synthesis of the data, and assembling the results for inclusion in a poster facilitates decision making on the best way to display and interpret the results. It subjects the author's work to peer review, albeit in abbreviated form.

Pragmatically speaking, having an abstract on the program is the only way many investigators can obtain permission and/or institutional support for attending an important professional meeting. More importantly for the work itself, presentation of the findings at a national meeting of one's peers gets the message out earlier than is generally possible with full peer-reviewed manuscript publication, thus speeding up the advance of knowledge and practice. And discussing the project and its findings with colleagues at the meeting nearly always yields insights, questions, and interpretations that alter and improve the final manuscript.

However, those benefits cannot be realized unless the abstract is correctly and expertly prepared—and accepted for presentation at the meeting. This article describes the components of an abstract, offers practical suggestions for optimizing the message and impact of each component, and provides general advice on abstract preparation and tips for increasing the likelihood that one's abstract will be accepted. Although experienced abstract writers may find useful things in this article, it is aimed primarily at those who are preparing and submitting an abstract for the first time.

My focus in this article is on the OPEN FORUM, the sessions for original research at the annual International Respiratory Congress of the American Association for Respiratory Care.[1] However, much of what is in this article also applies to preparing abstracts for other scientific meetings. Most of the discussion is about abstracts reporting research studies, although equipment evaluations and case reports are also included, because the OPEN FORUM accepts abstracts of those as well as of more traditional investigations.

What Is an Abstract?

An abstract is a condensed version of a full scientific paper. It describes a study and its results. It is a means of conveying to one's peers what was done and why, what was found, and what the implications are. Because it is strictly limited, either in the number of words it can contain or in the space it can occupy on a page, an abstract can be only a "bare bones" version of all the information pertaining to the study. On the other hand, the selection committee must decide whether to accept the abstract, and meeting attendees will decide whether to come to the session at which it is presented, just on the basis of what it contains. There must therefore be enough "meat," especially in the methods and results sections, to communicate the study's essential message.

Scientific papers have abstracts that are similar to but not the same as abstracts for presentation at meetings.[2] The format may be different, depending on the requirements of the society or the meeting. Meeting abstracts typically allow more liberal and extensive use of abbreviations than article abstracts, and they may contain references, tables, or figures. The abstracts of published articles are retrievable through electronic search engines such as PubMed. Although meeting abstracts are often published, either as supplements to or in regular issues of the host society's journals, they are not indexed by the National Library of Medicine and usually cannot be found by searching on the Internet.

That an abstract was published in the proceedings of a professional society's meeting does not signify that the society sanctions or otherwise endorses the research the abstract describes. Although many abstracts are published and can thus be cited as references in scientific papers, they are well below full peer-reviewed reports on the ladder of scientific value and should never be thought of as equivalent. They are not "publications" in the same sense as full reports, and they go in a separate section of the author's curriculum vitae. Some scientific journals do not allow citation of abstracts in reports they publish, and most journals at least discourage reference to abstracts.

An abstract is only an intermediate stage in a yet-unfinished project, completion of which requires publication of a full manuscript in a peer-reviewed journal.[3] In fact, most presented abstracts actually never see full publication. A recent systematic review of 19,123 research abstracts, presented at 234 biomedical meetings between 1957 and 1998, found that only 45% were ultimately published as full papers.[4] The proportion of OPEN FORUM abstracts that are subsequently published has not been formally determined, but I think it is substantially lower than 45%. There are many possible reasons, but the most regrettable is when the investigator/author fails to write up and submit a full manuscript of a publishable study.[5]

Preparation for Writing the Abstract

My mentor, Thomas L Petty, once explained to me the relative difficulty of presenting complex information clearly and concisely. To paraphrase Dr Petty's advice, on being asked to give a talk on a particular topic, "If you want a 10-min summary, I can have it for you a week from today; if you want it to be 30 minutes, I can do it tomorrow; if you want a whole hour, I'm ready now." Writing an abstract is in the first of those categories. There are few messages the gist of which cannot be distilled down to a

brief presentation, but to do so effectively requires clear thinking, careful planning, and concise, efficient communication.

Because putting together a good, professional looking abstract takes time, writing it should not be put off until the day before the final deadline for submission. This is especially important for first-time authors, who will benefit from discussing the project and from going over preliminary drafts with someone who has more experience. Enough time should be allowed for everyone listed as an author to have input into the abstract, and for each of them to sign off on the final version.

The purposes of a research abstract are to address in abbreviated form what should be communicated in a scientific paper:

- Why did you start?
- What did you do?
- What did you find?
- What does it mean?

The first of these questions applies to the introduction (or background), the second to the methods section, the third to the results, and the fourth to the conclusions. An abstract needs to contain concise but coherent answers to those questions, and nothing more.

Generally, a given study should be reported in a single abstract. There are legitimate exceptions, such as presenting the design and methods of a complex clinical study at one meeting and the findings at a subsequent meeting, or presenting 2 distinct aspects of the study (such as the overall initial results and then the complications or subsequent follow-up), especially if these are appropriate for different audiences. However, attempting to squeeze as many individual presentations as possible out of a single project, using the "LPU" ("least publishable unit") approach, although all too prevalent, is the publishing equivalent of polluting the environment. Any short-term gain for the individual investigator is at the expense of the greater scientific community, for which coping with an ever-increasing volume of new data constitutes an obstacle to progress.

Previously presented abstracts should not be reworded for submission to additional meetings. The same abstract can be presented at a local or regional meeting and then again at a national meeting, but not at more than one national meeting—even to different societies or audiences. Although a full paper may already have been submitted, the contents of the abstract should not have been published prior to its presentation at the meeting.

The first step in writing an abstract is to read the instructions. Professional societies nearly always provide guidelines and specifications for submitting abstracts to their meetings, and while certain things are common to all of them, there are important differences. Detailed, explicit instructions for preparing an abstract for the OPEN FORUM are posted at RESPIRATORY CARE journal's web site.[1] For many meetings there is a form on which the abstract must be printed. Printing the finished abstract on this form is one of the very last steps in the process. One should make copies of the form for working drafts, and save the original for the "*final* final" version, after all the rewrites, copyedits, and corrections have been accomplished.

First-time abstract authors especially may find it useful to read through the published abstracts from the most recent annual meeting. This helps to illustrate the concepts discussed in this article and to develop a feel for what a good abstract looks like. In addition, although they differ in focus and target audience, several published guides to abstract preparation are available.[6–13] For this article I have selected 3 abstracts from the 2003 OPEN FORUM that I consider particularly good examples from the perspective of format and style.[14–16] Figure 1 shows a representative abstract of an original research study.[14] Figure 2 illustrates a methods-and-devices abstract.[15] Figure 3 shows an abstract for a case report.[16]

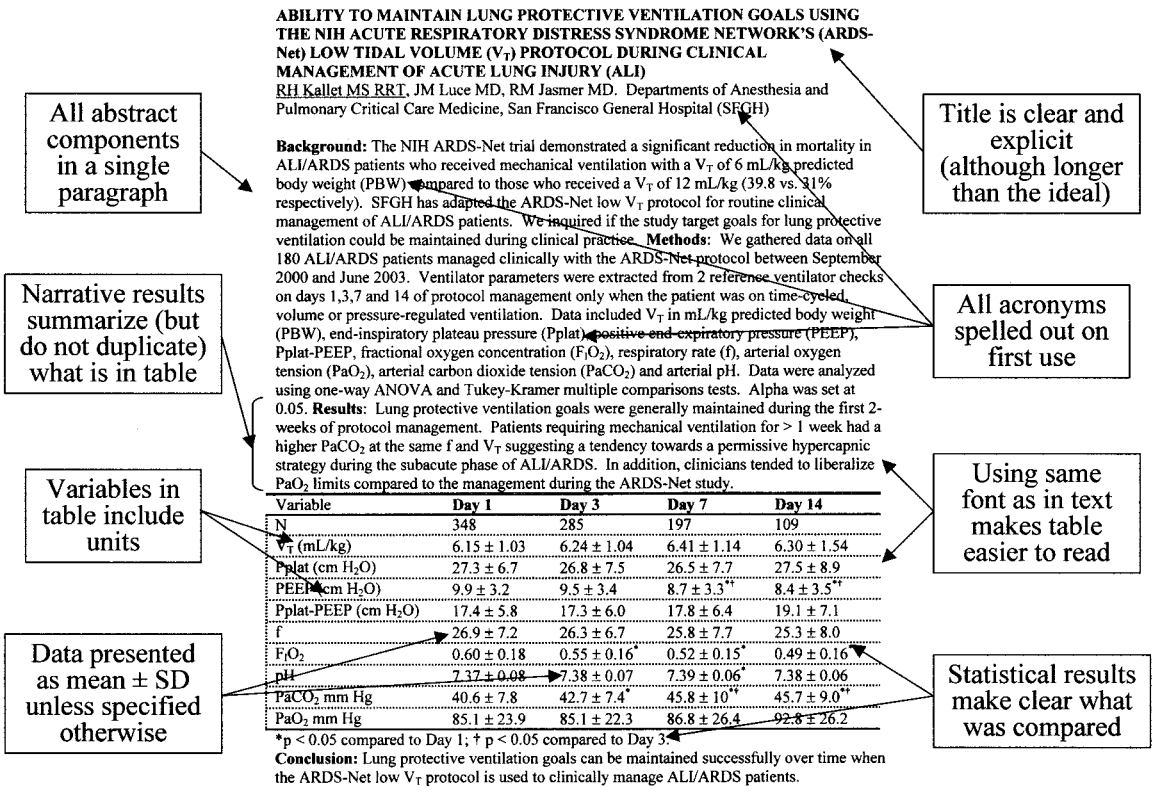
Title

The title should be an accurate promise of the abstract's contents. It should convey as much as possible about the context and aims of the study. In addition, an abstract's title is most effective when it refers to its overall "take home message."[7] Ideally about 10–12 words long, it should include the scope of the investigation, the study design, and the goal. In general it is preferable to make the title a description of what was investigated rather than to state the results or conclusions. Studies of published research papers whose titles were statements summarizing their results ("Recruitment Maneuvers Optimize Outcomes in ARDS") have found that the great majority of them overstep the implications of their data and are technically incorrect.

The abstract's title should be easy for readers everywhere to understand and should not include jargon or unfamiliar acronyms. Including key aspects of the study design is good ("A Survey of Department Managers' Attitudes on. . . "), but nonspecific phrases such as "A Study of. . . " or "An Investigation Into. . . " are redundant and should be avoided. Plays on words and cute or deliberately provocative expressions catch the reader's attention but tend not to wear well in the long run and may appear to trivialize the serious work being reported.

Authors and Affiliations

The list of authors should be restricted to those individuals who actually did the study—conceived it, designed it, gathered the data, crunched the numbers, and wrote the



ABILITY TO MAINTAIN LUNG PROTECTIVE VENTILATION GOALS USING THE NIH ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK'S (ARDS-Net) LOW TIDAL VOLUME (V_T) PROTOCOL DURING CLINICAL MANAGEMENT OF ACUTE LUNG INJURY (ALI)

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Background: The NIH ARDS-Net trial demonstrated a significant reduction in mortality in ALI/ARDS patients who received mechanical ventilation with a V_T of 6 mL/kg predicted body weight (PBW) compared to those who received a V_T of 12 mL/kg (39.8 vs. 31% respectively). SFGH has adapted the ARDS-Net low V_T protocol for routine clinical management of ALI/ARDS patients. We inquired if the study target goals for lung protective ventilation could be maintained during clinical practice. **Methods:** We gathered data on all 180 ALI/ARDS patients managed clinically with the ARDS-Net protocol between September 2000 and June 2003. Ventilator parameters were extracted from 2 reference ventilator checks on days 1,3,7 and 14 of protocol management only when the patient was on time-cycled, volume or pressure-regulated ventilation. Data included V_T in mL/kg predicted body weight (PBW), end-inspiratory plateau pressure (Pplat), positive end-expiratory pressure (PEEP), Pplat-PEEP, fractional oxygen concentration (F_IO_2), respiratory rate (f), arterial oxygen tension (PaO_2), arterial carbon dioxide tension ($PaCO_2$) and arterial pH. Data were analyzed using one-way ANOVA and Tukey-Kramer multiple comparisons tests. Alpha was set at 0.05. **Results:** Lung protective ventilation goals were generally maintained during the first 2-weeks of protocol management. Patients requiring mechanical ventilation for > 1 week had a higher $PaCO_2$ at the same f and V_T suggesting a tendency towards a permissive hypercapnic strategy during the subacute phase of ALI/ARDS. In addition, clinicians tended to liberalize PaO_2 limits compared to the management during the ARDS-Net study.

Variable	Day 1	Day 3	Day 7	Day 14
N	348	285	197	109
V_T (mL/kg)	6.15 ± 1.03	6.24 ± 1.04	6.41 ± 1.14	6.30 ± 1.54
Pplat (cm H_2O)	27.3 ± 6.7	26.8 ± 7.5	26.5 ± 7.7	27.5 ± 8.9
PEEP (cm H_2O)	9.9 ± 3.2	9.5 ± 3.4	8.7 ± 3.3*†	8.4 ± 3.5*†
Pplat-PEEP (cm H_2O)	17.4 ± 5.8	17.3 ± 6.0	17.8 ± 6.4	19.1 ± 7.1
f	26.9 ± 7.2	26.3 ± 6.7	25.8 ± 7.7	25.3 ± 8.0
F_IO_2	0.60 ± 0.18	0.55 ± 0.16*	0.52 ± 0.15*	0.49 ± 0.16*
pH	7.37 ± 0.08	7.38 ± 0.07	7.39 ± 0.06*	7.38 ± 0.06
$PaCO_2$ mm Hg	40.6 ± 7.8	42.7 ± 7.4*	45.8 ± 10*†	45.7 ± 9.0*†
PaO_2 mm Hg	85.1 ± 23.9	85.1 ± 22.3	86.8 ± 26.4	92.8 ± 26.2

*p < 0.05 compared to Day 1; † p < 0.05 compared to Day 3.

Conclusion: Lung protective ventilation goals can be maintained successfully over time when the ARDS-Net low V_T protocol is used to clinically manage ALI/ARDS patients.

Fig. 1. A well-prepared abstract reporting an original study,[1] taken from the 2003 OPEN FORUM.[14] This abstract includes a table, which permits inclusion of more data than would be possible with text alone. Note that the table consists of actual (mean) data—not percentages or trends. The comments and arrows indicate noteworthy features and illustrate points made in the text.

abstract. Author lists are rough rank orders of the relative contributions of the persons named, with the exception that the senior author (the mentor) is often listed last. In general, the author listed first is the person who conceived the study and did most of the creative work on the project. With few exceptions, this should be the person who will present the poster or slide presentation if the abstract is accepted. Full names and formal credentials should be used (eg, Elwood T Smith RRT) rather than nicknames and local job designations (eg, Corky Smith RCP). Only affiliations relevant to the study should be included—generally the department and institution at which the work was done.

The commercial connections of authors and researchers are coming under increasing scrutiny, and appropriately so. Our field is one in which devices and apparatus play a central role, and it is perfectly acceptable for studies to be industry-sponsored or for investigators who have connections to industry to write and publish abstracts.[17] However, such connections need to be "up front" in every aspect of the presentation and publication process if the work is truly to stand on its own merit. If a study was industry-sponsored, or if one or more of the authors is a paid employee or consultant to the manufacturer of the device being evaluated, this needs to be disclosed.

Introduction or Background

This brief section answers the question, "Why did you start?" and should provide a context or explanation for doing the study. Space is at a premium, so a short sentence or two must suffice. This section should also state the aim of the study, and ideally should include a concise statement of the study's hypothesis. A legitimate scientific study is not done *to prove that something is true*, but, rather, *to find out whether it is true*. The importance of that distinction may not be immediately apparent, but it actually makes a huge difference.[18] Thus, the hypothesis may be either that device X is superior to other devices, or that it is no different, but the statement of a formal hypothesis reinforces the investigators' objectivity and lack of personal investment in a particular outcome. It also focuses both the author and the reader on the abstract's true message. Here are 2 examples of concisely stated but informative study hypotheses:

- "We hypothesized that the use of mask A (in comparison with mask B) would decrease the incidence of unsuccessful NPPV attempts."
- "Our null hypothesis for this study was that pulmonary rehabilitation produces no change in psychological or

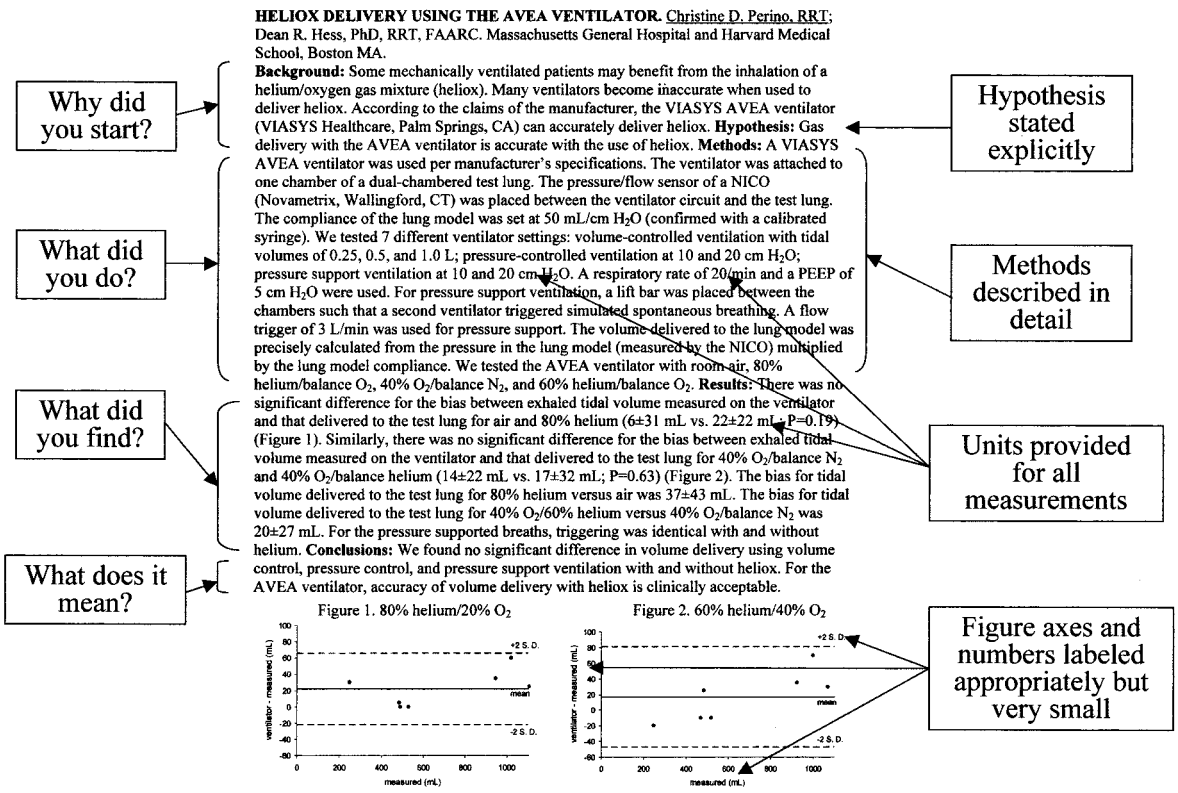

Fig. 2. An example of an abstract that describes a method, device, or protocol evaluation,[1] taken from the 2003 OPEN FORUM.[15] In this type of abstract the methods section should be particularly complete (as in this example), within the constraints of available space. Note that the text is written in the active voice (eg, "We tested. . . "), which should be used in preference to the passive voice whenever possible. The comments on the left show how this abstract addresses the 4 fundamental questions an abstract should answer, and those on the right point out other noteworthy aspects. Inclusion of 2 figures stretches the limits of the format, although the message is effective if the reader can read the tiny font.

physiological aspects of quality of life, as measured by the SF-6."

Methods

The methods section of a research paper could well be written before the research itself is begun and any data collected, and the same is true for abstracts. This section answers the question, "What did you do?" This is the section of submitted manuscripts that is most often identified by reviewers and editors as deficient and the reason for rejection.[19] In an abstract the description of the methods has to be concise, and many details of what was done must be omitted. However, in the space available the reader can be given a good idea of the design of the study, the context in which it was done, and the types of patients or measurements that were included. For a study involving patients or other human subjects, it should be explicitly stated whether the study was retrospective or prospective, and whether there was randomization. The source of the sample (eg, randomly selected, consecutive series, convenience sample) and the context in which the study was done should be specified.

Results

Here the abstract needs to tell the reader what the findings of the study were. Phrases such as "The findings will be presented" are unsatisfactory. Although space is limited, it is important to give the main results not just in subjective terms ("We found device X to be superior to device Y") but also in the form of some real data. The results that pertain to the study's hypothesis and that constitute the primary end points described in the methods, must be included—even if no statistically significant differences were found. Data from which the conclusions will be drawn should be reported in as much detail as space allows.

Sometimes a study is negative with respect to the primary outcome variable, although differences in one or more secondary or peripheral (or even unplanned) measurements may be statistically significant. The main hy-

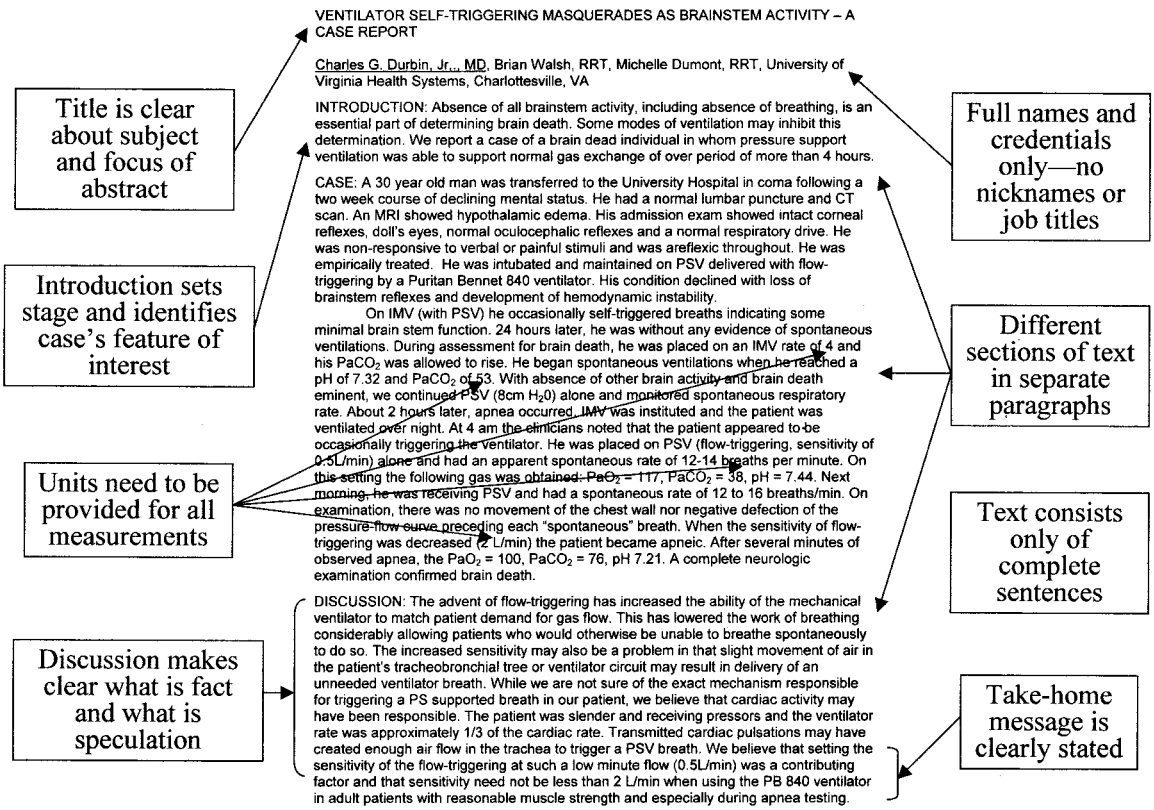

Fig. 3. An example of a well-done case report[1] abstract.[16] In this case, space permitted separation of the sections into discrete paragraphs, which facilitates communication of the message. Instead of describing the diagnosis and focus of the case (eg, "Ventilator self-triggering without respiratory effort in a brain-dead patient"), the title summarizes the conclusion. This approach can be effective as long as enough information is provided for the reader to understand the abstract's subject. In this example, the discussion does a particularly good job of staying within the limits of the available data, as well as of distinguishing between fact and speculation.

pothesis should not be lost track of in such cases. It is better to say that there was no difference in the primary outcome of the study (noting any additional results, significant or not, as space permits) than to refocus the study toward the findings that were statistically significant.

If the study was designed so that a difference with $p < 0.05$ would be considered significant, and the difference turns out to be $p = 0.09$ or 0.15, that difference is not significant—period. It is almost always a mistake to discuss trends and "almost-significant differences." According to the power and sample size estimations that should be made before the data collection begins, differences in the results will be either significant or not significant.

A table or figure may be included in the abstract if it conveys the findings of the study more effectively than text alone. The abstract will be reduced in size for publication (see Figs. 1 and 2), and labels and data points must remain legible if the table or figure is to be effective. The importance of careful attention to this point can be seen on examination of any group of published abstracts in which the intended messages of the tables and figures in some abstracts are diminished or lost completely because they are simply too small to make out. Whether a table or figure will enhance the message of the abstract or simply clutter it depends on the nature of the work and its findings; a table or figure should not be included unless it is necessary to convey the results effectively.

Conclusions

The conclusions section (for some meetings this section is labeled "implications") should be a brief statement of why the study's findings are important and what the author believes they mean. The most common mistake here is to make more of the data than they deserve. Conclusions should be reasonable and supportable by the findings of the study. If the study was restricted to certain patients, or to a particular therapy, or to the performance of a device under specific conditions, the results may not extend beyond those restrictions.

Some Writing Tips

Use simple declarative sentences. Active voice is preferable to passive voice: "We studied 15 patients with

ARDS." is much better than "Fifteen patients with ARDS were studied."

Use generic names for drugs and devices, unless the specific brand used is a key aspect of the study. For example, if the abstract reports an evaluation of a particular ventilator's response time to patient inspiratory effort, the ventilator needs to be identified by name. But if the study was about some aspect of ventilation that is not specific to a certain ventilator model, such as the effects of positive end-expiratory pressure on arterial oxygenation, the name of the ventilator is irrelevant.

A few abbreviations are so familiar that they do not need to be spelled out in the abstract on first use, but there are not many of these. Examples in our field are COPD, PEEP, FEV_1, and P_{aCO_2}. However, an abstract's readers may have widely different backgrounds, and all but the most commonplace abbreviations or acronyms should be spelled out the first time they appear. There must also not be too many of them, or the abstract's flow will be slowed and the reader will be bogged down in the communication, missing the intended message. Local expressions and jargon should be avoided, and one should be especially cautious about coining new abbreviations for expressions specific to the study being described.

The abstract-preparation instructions may specify which font to use and are usually clear about margins and minimum sizes. Use of a proportional font such as Arial or Times New Roman, as opposed to a mechanical or nonproportional font, will permit more words to be squeezed into the allotted space. However, it is important not to try to get around the rules by using a smaller font or decreasing the line spacing below single-spaced. These things show. The abstract should be prepared exactly as the instructions say.

Important Things to Do Before Final Submission

Despite good intentions, there is often a rush to complete and submit the abstract before the deadline passes. It is important to re-read the instructions before printing the final onto the submission form, and to make sure they have been followed to the letter. The goal should be not to have a single grammatical mistake, misspelled word, or typographical error. A frustrating reality of abstract submission is that, despite repeated proofreadings, errors often remain invisible to the author who has labored so long over it. It can be very helpful to have someone unconnected with the study read the abstract. Before the final draft is submitted, every listed author must read and approve the abstract.

Summary

Preparing an abstract for presentation at a scientific meeting is an integral part of the research process, and aids the completion of a project in several ways. Success in abstract writing comes from application of the same basic principles that promote success in research. Focusing on the primary issues of why the work was done, how it was carried out, what was found, and what the potential implications are, is the most important strategy for preparing the abstract. In the writing process, clear, direct communication, strict adherence to published specifications and format requirements, and careful proofreading will increase the likelihood of producing a high-quality abstract and of having it accepted for presentation.

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